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Abstract

METALLURGICAL PROPERTIES OF SOME URANIUM ALLOYS

by

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Fxperimental work on some dilute uranium alloys, especially on the uranium-molibdenum system, is reported.

An alloy with 0.5 wt. % Mo (total impurities in uranium about 1000 ppm) in as-cast condition has fine fairly equiaxed grains ranging from 150 to 250 microns. The grains are completely occupied by a lamellar perlite. This alloy was subjected to long term annealin in a high alpha phase temperature range. It was fairly convincingly shown that the grains did not undergo any pronounced enlargement by annealing at 450 to 550°C for 2500 hours. In the alloy subjected to annealing at 550°C for more than 2500 hrs., an observable grain growth took place. Isothermal treatment of the alloy in the range of the upper "C" curve yields, after the transformation is complete, relatively fine alpha grains whose size decreases with decreasing temperature of the treatment. The average grain size obtained by isothermal treatment at 550°C was 35 microns and did not significantly change after heating for 2000 hrs. at 550°C. Quenching from the gamma range in water and salted water gives, besides the beta phase, a fine needlelike α'_a phase. This martensitic phase is athermal and probably results from the direct decomposition $\gamma \rightarrow \alpha'_a$. Quenching from the $\beta+\gamma$ and β range gives no athermal martensitic phase.

The ternary system with aluminum shows a pronounced cooperative effect of molibdenum and aluminum upon the grain size in the as-cast alloy. The finest and most regular grains (50 microns in average) are obtained with the 0.6 wt. % Mo and 500 ppm Al alloy. The modified Jominy-test shows that the cooling rate has a less effect upon the alpha grain size in this alloy than in the U-O.5 wt. % Mo alloy.

The present investigation of the kinetics of phase transformations in the U-Nb system (up to 5 wt. % Nb) indicates a slight beta phase stabilization. In the range of 2-3 wt.% Nb a significant change in microstructure and lattice parameters of alpha uranium were observed.